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Entrepreneurial Assembly of Options in the Design of a Digital Health Business

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Abstract

Although modular design methods provide digital entrepreneurs flexibility in technology design and strategy, little is known about the decisions and tradeoffs between the modules (parts) and the overall offering (whole). In this study, we seek to understand *how an entrepreneurial firm approaches the design decisions of the features and the whole offering to achieve strategic flexibility.* We leverage an inductive embedded case study of an entrepreneurial firm designing a digital health platform-based business over eighteen months. We find that entrepreneurs assemble a portfolio of design options by prioritizing client requests and aggregating them into a platform design. This approach led to a focus on individual features instead of interdependencies in the overall platform and reduced strategic flexibility for the firm in the long run. We contribute to the digital innovation literature by highlighting how digital entrepreneurs assemble a portfolio of design options to strive toward strategic flexibility in the design process. We also expand on our conceptualization of modular design and the role of design option in modular design. We argue that the notion of design option is particularly critical in the design decisions of platform-based systems for the system to coevolve with the business strategy.

Keywords: Digital entrepreneurship, systems design, design options

1 Introduction

In a digital platform-based business, business strategy and technology design are highly intertwined (Lyytinen et al., 2016). The product offering (i.e. platform) is a technological modular system that evolves over time (Baldwin and Woodard, 2008). As changes occur in the product offering, some of the modules or their interfaces in the system need to undergo changes.

The changes in business strategy are rampant particularly in the early years. There is nascent understanding of the product, the market, as well as broader societal and economic environmental changes (e.g. Ojala, 2015; Kranz et al., 2016). The product needs are still highly ambiguous, as the customer and user bases are still influx (Nambisan, 2016). The early technology designs are made up of prototypes and impose many limitations on the business strategy.

Hence, not surprisingly, a critical organizing logic for a digital platform-based business is strategic flexibility (Tiwana et al., 2010; Lyytinen et al., 2016). S*trategic flexibility* refers to the ability of a firm to reallocate and reconfigure its organizational resources, processes, and strategies to deal with environmental changes (Sanchez,

1995). Such flexibility is paramount in the design process due to uncertainty in business strategy and product requirements. Entrepreneurs seek to minimize commitments in technology designs that fail to be reusable as market and product requirements may change. Strategic flexibility also calls for flexible design processes (Sanchez 1995).

Fortunately, modular designs and flexible development approaches have become commonplace even in the entrepreneurial firms (e.g. Ries, 2011). For example, modular designs offer firms options for design and ways to capture value as the technology evolves (Baldwin & Clark, 1994). In modular designs, elements of the technology are differentiated into separate modules. Modular designs allow features to be added without major disruptions to other modules (Baldwin & Clark, 1994). Specifically, in platform design, the platform architecture is partitioned into a set of core components with a complementary set of 'peripheral' components (Baldwin and Woodard, 2008). We refer to these peripheral components as "features".

Despite the flexible development approaches, much of the strategic flexibility challenge remains. For example, use of Agile methods does not resolve the chicken and egg problem of product requirements and clients/users. The Agile method assumes the presence of a known target user who can help identify features and later iterate in the development (Paetsch et al., 2003). An entrepreneurial firm in its formative years may find it difficult to identify interested clients and users without the evidence of a workable product with some key features already designed.

Additionally, Agile and other modular methods do not eliminate the path dependence problem. Even modular designs have strong interdependences. The core components of the platform need to be designed before peripheral features become viable; yet the clients and users may only see the value of features specifically designed for them. These interdependencies between the core and the periphery constrain the coevolution between strategy and technology design (e.g. Sydow et al., 2009; Vegne & Durand, 2010; Singh et al., 2015). These relationships can get further muddled by young entrepreneurial firms facing escalating pressures from their investors in the early years to increase revenues. The focus for these firms becomes selling peripheral features without ensuring robust core product (e.g. Nambisan, 2016; Tiwana et al., 2010). While digital products are generally considered as "intentionally incomplete" (Garud et al., 2008), this incompleteness and its consequences are unlikely to be the same for the core and peripheral parts of the platform product.

To recap, although modular design methods provide digital entrepreneurs flexibility in technology design and strategy, little is known about the decisions and tradeoffs between the modules (parts) and the overall offering (whole). Specifically, *how does an entrepreneurial firm approach the design decisions of the features and the whole offering to achieve strategic flexibility*?

In this study, we examine the design process of a digital entrepreneurial firm, PatientFirst, in the healthcare space. This firm was selected, as it was deemed to be a revelatory case of strategic flexibility. Not only was the firm's vision to participate in the nascent care coordination health services space, the firm's designers lacked knowledge of their clients, their needs, as well as the overall healthcare economic and political environment. The firm's plans was to develop a highly modular technological platform that would meet requirements of a wide variety of clients who had a need to communicate with patients in pre or post treatment phases.

For example, the firm envisioned the system to be used by health care professionals and the patients in the post-treatment phase. A patient would report post-treatment side effects or blood pressure readings through the system, so that the clinicians could review them in the clinic. The platform included various components to meet nurse and patient communication needs. But physicians would also use the system to create content. The platform comprised of core that contained the communication and user content creation modules as well as many peripheral components (so called features) that were tailored to specific clients. The components were delivered either through organization-branded app or web portals. The business model called for licensing of the software as a service to all clients. Although the firm envisioned itself as the sole designer of the initial platform, the long-run plans included third party content providers and developers.

An eighteen-month observational study was conducted in PatientFirst after the 1.5 years of the firm's founding. The observations focused on understanding how entrepreneurs assemble a portfolio of design options by prioritizing client requests and aggregating them into a platform design. We define *design options* as *the right to undertake certain design initiatives, such as deferring, abandoning, modifying or scaling an existing design, from the initial investment.* One of the early findings was that designers were focused on the individual features meeting a specific customer's requirements with little regard to the interdependencies in the overall system. The lack of attention to the overall system had detrimental effects on subsequent designs as well as the business strategy.

Our findings make several contributions. We contribute to the digital innovation literature by highlighting how digital entrepreneurs assemble portfolio of design options to strive toward strategic flexibility in the design process. However, some of the decisions aimed toward strategic flexibility appeared to limit strategic flexibility in the long term. We also expand on our conceptualization of modular design and the role of design options in modular design. We argue that the notion of design option is particularly critical in the design decisions of platform-based systems for the system to coevolve with the business strategy.

The remainder of this document is structured as follows: In the next section, we review the strategic flexibility literature before examining the digital innovation, information systems design and real and digital options literature. Thereafter, we describe the data sources, study site and explain the analyses conducted to date. We will then present and discuss the preliminary findings.

2 Conceptual Background

We begin with a brief overview of strategic flexibility in the extant literature.

2.1 Strategic flexibility

In strategic management, strategic flexibility pertains to a dynamic capability for firms in uncertain, volatile environments (e.g. Sanchez, 1995). Firms need the capability to change their course of action, such as change their mix of products or a set of markets in response to internal or external changes in the environment. A firm's strategic flexibility depends on the firm's ability to use its available resources (Sanchez, 1995) and leverage them in a viable business model (e.g. Ojala, 2015;

Kranz et al., 2016). In an entrepreneurial firm, these resources often need to be developed internally, as there are limited resources to acquire them on the market. Also, the resources may be unique or novel and not available outside the firm. Strategic flexibility in an entrepreneurial firm then means developing resources and coordinating them to create value such as new product strategies or organizational forms. What is less discussed in the strategic management and entrepreneurial literature is how firms such develop the resources internally that contribute to the strategic flexibility with limited resources (e.g. Zhou & Wu, 2010; Bierly & Chakrabarti, 1996; Sanchez 1995).

2.2 Designing Digital Resources for Strategic Flexibility

The information systems literature and particularly scholars of digital innovation (Zittrain, 2008: Yoo et al., 2010) address the development of digital resources for strategic flexibility. The literature has identified a number of design principles including generativity (Zittrain, 2008), layered modular architecture (Yoo et al., 2010) and interoperability standards (Tilson et al., 2010). These design principles accommodate strategic flexibility. The modular architecture facilitates recombination (Henfridsson et al., 2014) or repurposing of these resources (Antonopoulou et al., 2016). Both recombination and repurposing make alternative courses of action possible. The literature demonstrates how recombination and repurpose have enabled entrepreneurs to exploit new business opportunities efficiently (Bharadwaj et al., 2013) and offer clients new value propositions (Pagani, 2013). These design principles create an offering that can meet the needs of diverse clients by creating an assembly of different product features for the clients.

To begin to understand how design processes can prioritize strategic flexibility, I review what existing IS design methodology literature informs us about information systems design approaches.

2.3 Information Systems Design Approaches: Agile Method

Design approaches culminate in different information systems design approaches including the Agile method (e.g. Beck et al., 2001; Abrahamsson et al., 200) that has gained popularity worldwide. The Agile method recommends organizing design processes in rapid prototyping cycles to avoid waste in upfront development (Beck et al., 2001; Conboy, 2009). The rapid cycles are argued to reduce cost and increase quality in complex projects (Cao et al., 2013). The prototypes of rapid cycles establish a common basis for understanding and communicating design requirements between designers and stakeholders, particularly the key users (Mathiassen et al., 1995). As the understanding between the designers and users increases, so does the quality and completeness of requirements. The rapid cycles enable the designer to respond quickly to changing requirements (Highsmith & Cockburn, 2001; Lee & Xia, 2010). However, the Agile Method assumes a focal user or a set of users who participate in the design process. Investment of resources for design is based on the feedback from users who are known ex-ante or emerge during the design process (Paetsch et al., 2003).

In the platform-based design, the focal users are unknown as are their diverse needs (Antonopoulou et al., 2016; Nambisan, 2016). While the modular architecture can facilitate the design of new modules without disrupting the core components of the platform, there is still uncertainty of how these emerging opportunities are

identified, what user input needs to be acquired and integrated, and what interdependencies may emerge (Lyytinen & Damsgaard 2001). Thus, although the use of Agile methods with modular design allows flexibility in the timing and prioritization of design resources (Conboy, 2009), we still know rather little of the integration of resources, or their assembly, for strategic flexibility.

2.4 Real Options And Digital Options

Similarly outside the information systems literature, much of the focus on approaches for strategic flexibility has been on resource allocation approaches, such as real options (Klingebiel & Adner, 2015), rather than the assembly of resources. In the organization sciences literature, real options help firms to think about their capital investment projects. Real options entail small investments in the project to hold the right to exit or exercise the option in the future when more information about the payoff is available (Bowman & Hurry, 1993; Kim & Kogut, 1996). Using the real options approach, firms make sequential commitments to a course of action, and reduce uncertainty through updated information as these decisions unfold (Adner, 2007). Resources could then be allocated away from real options deemed to have low payoffs, thus reducing the risk of investment. When firms have flexibility concerning the timing and structure of technology related investments, they can make small, non-recoverable investments as positioning bets on new products (Dixit & Pindyck, 1994). With information over time, firms can choose to abandon the option or exercise the option by making further investments. Real options provide firms with flexibility in investment in capital projects, while accounting for the inherent uncertainty and irreversibility of these decisions (Tong & Reuer, 2007; Fichman, 2004).

The real options literature, however, does not consider the assembly of a portfolio of real options for strategic flexibility of the firm. The literature assumes that each option increases flexibility and reduces uncertainty for the firm (Dixit & Pindyck, 1994). For example, the literature is silent on whether the real options are assembled sequentially or in combination with other real options. Also, the literature does not address the nature of the interdependencies between real options. Yet, such interdependencies are likely to be critical in platform-based businesses where interoperability and predefined interface standards allow different modules to rely on the services of other modules (Gawer & Cusumano, 2008).

Information systems scholars have also contended that digital investments have option-like characteristics particularly in decisions related to subsequent investments (e.g. Benaroch & Kauffman,1999; Fichman 2004). Other scholars (e.g. Sambamurthy et al., 2003; Sandberg et al., 2014) expanded on this perspective, by suggesting that digital capabilities can be linked to business performance through digital options, which are IT enabled capabilities that build incrementally and render cumulative commitments toward value creating information technology infrastructures and services (Sambamurthy et al., 2003). However, these studies mostly focus on technology investment decisions from the perspective of the adopter of the technology, as opposed to that of the designer of the technology. Little is known in the literature about the design of an option that may be later acquired through some form of monetary transaction, like in the case of IT investments examined using the real options or digital options approach. An entrepreneurial firm with a vision of a platform-based business likely seeks to design the options rather than acquire them.

To recap, the literature has identified the concept of digital optiosn and real options and recognized its value for strategic flexibility. Yet, we know little of the investment in design options and decisions and tradeoffs from the designers perspective in an entrepreneurial firm with limited resources.

3 Methods

To explore the research question, we employ a longitudinal, inductive embedded case study that. We constructed twenty embedded cases of key features designed for the health IT platform.

3.1 Research Site

PatientFirst (a pseudonym), a three-year-old entrepreneurial firm in the United States, was selected as the case study site. I selected the context because: 1) the digital entrepreneurs were designing a health IT platform meant to disrupt existing care delivery processes, and 2) unlike its competitors that targeted specific segments within the healthcare market, PatientFirst's goal was to design a platform that could cater to diverse clients.

Two serial entrepreneurs founded PatientFirst. The co-founders included the chief executive officer (CEO), and the chief designer, both with previous successful entrepreneurial firms. The remaining designers and customer liaison all had prior experience working in entrepreneurial firms and software design knowledge. No one in the firm had healthcare experience.

During the period when the study was conducted, PatientFirst experienced immense resource constraints and pressure to generate revenue. As the chief designer announced in an email:

> "*we are still on the track to* ***run out of cash*** *[at* ***Month 26****]… [****Months 18-21]*** ***was exceptionally slow*** *for new business* ***… fumbled on deals*** *that we anticipated would get us to cash flow positive. … We naively thought we could hack healthcare / enterprise sales with a SaaS like solution, but the reality is we're an enterprise company and the sales cycle is 9-12 months on average."*

This quote sets the context in which PatientFirst was operating for most of the duration of this study (Month 16-33). Financial pressures were mounting for the firm. During this period, the CEO marketed the technology to diverse clients in different settings. Part of this strategy was driven by the desire to be a health IT platform for any interested client. The other factor was the pressure from investors to deliver results. As an investor who was also the CEO of Client C reflected on the progress of PatientFirst said, "*As a user, I would give them an A. As an investor I'd give them a B-, as I'm still not seeing the returns on my investment"*. This was an example of the tensions PatientFirst faced between working closely with users to design a user-centered platform and generating revenue from diverse clients. Another investor began to introduce the CEO to other opportunities outside of the market segments he had been exploring. She said, *"When I look at [their] technology, and I see its capabilities.. I see [different] kinds of possibilities."* In this case, the investor saw a potential match between the PatientFirst's platform and needs of a employee benefits management company. The investor believed that PatientFirst should leverage its platform capabilities to capture new business opportunities. She also emphasized that sales and revenue were critical to a young entrepreneurial firm. Strategic flexibility

was hence important to PatientFirst, as it sought to capture business opportunities in different markets to ensure continual survival of the firm.

3.2 The Health IT Platform

PatientFirst created the health IT platform to help nurses educate and communicate with their patients in the pre or post treatment phase. The PatientFirst platform included backend platform core, peripheral features, mobile applications and web portals that have to be coordinated in the design process. The entrepreneurial firm licensed the health IT platform to clients, such as a home health agency and a population health management company. While these clients were all in the healthcare industry, they had very different use cases and feature requests. For instance, Client C was a small specialty treatment center that sought to improve patient satisfaction using the platform, whereas Client A was a large home health agency that spanned multiple regions with home health aides as the primary users, and not patients. The designers thus had to manage the prioritization of features in platform design to meet different user requests and revenue targets. After the platform was implemented at its first client site in 2014, PatientFirst released updated versions of the platform every four to six weeks. These versions included new features or remedies of defects. Users accessed the features on the platform through organization-branded mobile applications or the web browser.

3.3 Data Sources

Data collection occurred over an eighteen-month period from July 2014 to December 2015. The primary set of data included: (1) 1956 pages of chat transcripts amongst the designers in an online chat room, stemming from the firm's early months (9 months old), (2) 2370 design tasks from an online project management tool, (3) 1412 emails exchanged, and (4) access to the founders' calendars. The archive of digital communication was triangulated by (a) 21 semi-structured interviews with the employees and founders, its clients, investors, and industry experts, (b) first author's field notes and (c) internal documents and public information about the firm. The first author also worked as a paid intern for eighteen months.

What was particularly interesting about the data sources is the availability of chat transcripts, which preceded the start of this study. Discussions between designers or amongst the group often occurred in the online chat room. While some of the conversations occurred through private messages or in person discussions, the archive of digital communications was nonetheless a valuable source of information. Analysis of conversations allows researchers to generate insights that may otherwise be unobservable and neglected (Kyprianou, Graebner and Rindova, 2015). Use of archival data also allows for convenient recursive iteration between theory and data for process theory building or emerging ideas in the theorized process (Levina and Vaast, 2015). The data was coded using Atlas.TI, a qualitative data analysis program, to keep track of emerging codes and themes.

3.4 Data Analysis

To analyze the data, we utilized thematic analysis methods (Boyatzis 1998). The first author read through all the data sources outlined in Section 3.3 and conducted a detailed line-by-line coding of the data. She wrote memos, tracked patterned activities through diagrams and summaries, as ideas for constructs and relationships emerged.

These case summaries included general descriptions of the firm, the industry and alternative explanations for events and phenomena of interest.

3.5 Coding

In the first phase, we coded broadly for actions and practices associated prioritization and software design practices at the firm. The understanding of these discussions was informed by the first author's understanding of the dynamics between the designers from hours spent observing and working alongside the designers. Conversations revealed the tensions between designers and disagreements on how features should be designed. First order categories that emerged included "minimal requirements", "overthinking", "unnecessary action", "future iteration", "immediate deliverable", "exploration of market", "funding constraints", and "resource constraints". We then sampled on conversations that included discussions and decisions about feature prioritization and design to identify the decision making process. We coded the data for feature attributes (e.g. user interface, user experience, permissions), action (e.g. justification, sharing), perceived opportunities, rationale and feature origins (client initiated or designer initiated).

In the second phase of coding, we sorted the identified codes into potential themes, such as "minimal resources for design", "prioritization of features", "capturing emerging opportunities". We drew thematic maps to capture the relationships between the themes. Additional data on decision outcomes was also coded to fill in the gaps in the thematic maps. We included codes for the impact of decisions made on future sales, use of products, defects and interdependencies in the dataset and impact on firm strategy. There was frequent iteration between data and themes to ascertain whether the themes reflected the meaning of the data. Further analysis is underway to identify themes associated with design options.

4 Findings

4.1 Finding 1: Entrepreneurs Addressed Client Requests and Strived to Increase Strategic Flexibility By Assembling a Portfolio of Design Options.

In response to the client requests, the entrepreneurs would design features. However, the entrepreneurs approached the design of these features as investment in design options. Instead of dedicating resources to iteratively seek user feedback, resources were directed to investing in more design options for strategic flexibility. This enabled the firm to focus on assembling a portfolio of design options that could be deployed for different strategic actions in the future.

PatientFirst designers began to assemble a portfolio of design options as they developed their business strategy. Each design option corresponded to a clients needs from different business opportunities. New features were prioritized if they were associated with expected immediate sales and/or possible entry to new market segments. To capture certain clients, PatientFirst had to design features clients requested. As the CEO said, features such as these that were *"important from the executive perspective*" were pushed to the top of the priority list. For instance, an investor introduced PatientFirst to an employee benefits management client that was not part of PatientFirst's original business strategy. The caveat for the sale was that

PatientFirst had to design a web portal for patients' use. This was not part of the firm's initial product vision. The designers quickly put together a web portal for patients to close the deal. The designers ended up modifying the existing nurses' web portal and putting exceptions on the backend for patient or nurse credentials to account for the different usage patterns. The chief designer explained, *"The client conveyed it [as a deal breaker] … We really wanted [the client] We made it pretty quick… That continually haunts us … the [web] dashboard was never really intended to be patient facing"*. Although the patient web portal was something PatientFirst designers considered designing eventually, they had not planned to invest resources to its design in the short term. However, to capture the revenue, they had to reallocate resources to designing the patient web portal. Because of the business opportunity that arose, they had to move the design of the web portal to the top of the priority list.

Strategically, PatientFirst was uncertain if the specific market (e.g. the employee benefits market) would be relevant to them in the long run. However, saying no to designing the feature meant: 1) losing the revenue, and 2) missing the opportunity to enter this market segment and possibly expand in the future. Being able to capture this new opportunity increased PatientFirst's revenue and the likelihood of raising additional capital. It also enabled PatientFirst to scale the feature in the future if it expanded to other clients in the employee benefits market. Desired strategic flexibility to capture emerging opportunities (known and potential) thus motivated investment in the feature. Cumulatively, the portfolio of features dictated the product road map.

However, during the design of each feature, designers would often weigh the additional development time required and not prioritize the downstream implications. For example, the design decisions of a 'Share my Care' feature that provided permissions for family members and other significant others to access the patient's care instructions highlighted this trade-off. The iOS designer raised the need to rewrite the associated code with the permissions to ensure that the patient privacy concerns were addressed in the overall offering. He argued that it should not be integrated with another feature and that they should invest resources now to develop the feature properly, or the else the interdependencies would be hard to untangle in the future. However, the chief designer responded, *"But we're not rewriting at this junction, that's my point. …*." He further challenged the iOS designer, *"and you're proposing what exactly? That we miss our [Client I's] 400 employee rollout and 8000 employee rollout Oct. 15th, to rewrite a problem that doesn't really exist at this junction?"* The chief designer elaborated that the interdependencies between features were inconsequential at the present time from his perspective and would be best addressed at a "future" (unidentified) time. The postponement of iteration and integration meant lack of resources dedicated to refining a feature and the investment in the backend architecture of the offering.

Each feature was thus designed with the idea that it would be a design option, as opposed to a complete feature. The chief designer, CEO and CTO often talked about "starting with [something] and iterating" from there. For example, in response to the debate about the 'Share my Care' feature above, the chief designer said, *"If we need to better support the idea of relationship down the road, we can. [Client I] won't be jeopardized.."* The chief designer was unwilling to make the modification and deferred additional discussion about this issue to the future.

4.2 Finding 2: There was a Lack of Separation of Function Versus Feature During Investment in Design Options.

It became evident that every user request associated with a business opportunity resulted in the design of a new feature (i.e. design option) that could be plugged into the existing platform. The client requests did not direct resources to the investment in design of the core components of the platform. Separation of function and feature only became evident when a new employee raised the possibility of incorporating the user request into an existing component.

This was demonstrated by contrasting how PatientFirst approached design for interested specialty pharmacy clients early in platform development versus its approach a year later. PatientFirst had been in discussion with Client L, who would be the first major specialty pharmacy client in its portfolio. Client L requested a medication adherence feature. The CEO justified the importance of catering to the requests of this client to his team by saying, *"This one comes from [potential new client L], which has 60 clinics, 90k new patients a year."* During initial discussions, the CEO proposed designing the medication adherence feature as a separate app and the chief designer brainstormed ideas that involved the design of a separate feature. However, the iOS designer was concerned with the interdependencies and extra work. He responded, *"We already have so many apps that we have to maintain, and that number will rise with almost every new customer.*" The iOS designer was concerned about the resources needed to maintain a separate organization-branded medication adherence app for each client to access the platform. Eventually, client L did not sign a deal with PatientFirst. As a result, the feature was not designed.

However, about a year later, discussions about this feature resurfaced. There was interest from another specialty pharmacy company for a similar medication adherence feature. However, instead of attempting to develop a new feature compatible with the platform core as the CEO had proposed before, they achieved the same functionality by expanding the scope of the existing task feature. This shift in perspective was prompted by a new designer who questioned why the focus was not on "enhancing the core infrastructure we have instead of building something entirely new". The chief designer and CEO reflected and concluded that building the medication adherence into the platform core will allow PatientFirst to gain efficiencies. Efficiencies included retaining existing nurses permissions model for platform access and care plan template model. Incorporating the functionality into the core component will require less maintenance compared to designing the medication adherence function as a new feature.

Although this was a major potential client, PatientFirst's approach towards designing for the medication adherence function became less ambitious. Instead of building a new feature, they decided to alter the existing task feature to accommodate a medication task type that could better support dosage complexities and enhanced (local) reminders on smartphones. While incorporating this function into existing core components required rewriting of code, the designers believed that this would improve the user experience for complex medication regimens, and set up the foundation for alternative care plans in the future. Expanding the scope of the existing task feature (a core component in the platform) would hence increase the performance and capabilities of the platform core. This demonstrated how even in the design of a

design option, separation of function and feature could lead to efficiencies not discussed early in the design process.

4.3 Finding 3: Focus on Individual Design Options, Instead of the Overall Platform, Limited the Firm's Strategic Flexibility in the Long Run.

The firm faced pressures from investors throughout the duration of this study to demonstrate revenue increases and to capture emerging business opportunities. As a result, the entrepreneurs approached the design of each feature as a design option associated with capturing a specific business opportunity. However, in doing so, the designers were distracted from the business and platform offering as a whole. Resources were diverted from discussions about interdependencies between design options or the platform offering as a whole

For instance, in a conversation between the CTO and iOS while designing care plans, the iOS designer was trying to clarify how to model the interdependencies between care plans and the disease states on patient profiles. However, the CTO said, "*I wouldn't read too much into the relationships between disease states and therapies. Which may turn out to be an overall weakness of the design. There are some things here we don't know.*" In this case, because they were trying to be generic and client-specific, they were designing for the unknown client. The iOS designer replied, *"Well, I'm just trying to figure out how to model the app for [version 1]. We can change it later, but the more you change the model later the more than sucks since you have to write a bunch of upgrade code*". However, instead of addressing the potential typologies of care plans and disease states, the CTO decided to defer this discussion to a later date. Focus on assembling design options for the short term resulted in a lack of consideration of interdependencies and long-term system performance. To exercise these design options, effort would have to be dedicated to rewriting the code to enable the desired expansion in features.

Because of the myopic focus on the investing in individual design options, the performance of the platform suffered. The negative consequences were evident in interviews with potential clients that chose not to proceed with the PatientFirst platform. The informants indicated that the lack of iteration and blindness to interdependencies and quality of the platform as a whole presented risks that some clients recognized as it became evident when evaluating the technical quality. One of the major clients who decided not to license the platform said, "*There was a good percentage of the code on that front end that would need to be rewritten to conform to a larger audience*." Technical robustness was an important criteria for bigger clients, as the platform would provide critical health information for making health including life and death decisions When the PatientFirst technology was reviewed by bigger clients with technical team, the cracks in the system robustness began to surface. These interviews highlight the challenge PatientFirst faced trying to grow within these market segments. PatientFirst's designer wanted to gain strategic flexibility using its portfolio of features. Yet, as PatientFirst tried to grow within the market, they met bigger clients who had more stringent requirements for the technology and thus deficiencies in the platform as a whole limited PatientFirst's ability to respond to business opportunities and reduced strategic flexibility.

5 Discussion and Implications

In this study, we set out to explore how a digital entrepreneurial firm *approached the design decisions of the features and the whole offering to achieve strategic flexibility*. Finding 1 illustrates how entrepreneurs approach the design of each feature as a design option and resource for increasing strategic flexibility. Finding 2 highlights a lack of discussion on function versus feature during the design of options. Finding 3 suggests that a focus on individual design options distracted from the digital business and platform offering as a whole. This had negative implications for the platform as a portfolio of design options. Collectively, the findings suggest a tension between features targeted at specific users and the whole (assembly of functions) for new business opportunities.

The findings contribute to the information systems design literature and the platform-based business literature. The contribution is twofold: (1) conceptualization of a design option and (2) theorization about the assembly of design options.

5.1 Conceptualization of Design Options

The study's key finding was the elaboration of the design option from the designers' perspective. The design option is important, as it allows platform based business entrepreneurs to allocating its design investments in a way that maintains strategic flexibility for the firm in the short term. In the real and digital options literature, the investment is associated with a monetary transaction (e.g. Bowman & Hurry 1993; Kim and Kogut, 1996) or derived from existing IT investments (Sambamurthy et al., 2003; Overby et al., 2006). The scope of the investment is thus assumed to be a given (e.g. Benaroch & Kauffman, 1999; Fichman 2004; Sambamurthy et al., 2003). However, in the case of digital entrepreneurs, the investment in the design option amounts to investment in time, effort or technical resources in the design of the feature. The design option provides the firm with a subsequent right to expand or abandon this feature. Thus, what is absent from the discussion in the real and digital options literature is the nature of the investment in design of options to create design options.

In finding 2, it became evident that to gain strategic flexibility for operating in the specialty pharmacy market, PatientFirst could choose to design a new feature or expand on the scope of an existing feature as the design option. The decision to design the medication adherence functionality into the platform core highlighted how different investments could offer the firm the same strategic flexibility in the short term with respect to business opportunities. To our knowledge, the literature has not considered the availability of alternative investments in real options with the same strategic payoffs and ways to evaluate them. Better understanding of how investments in design processes are made can allow the designers to make more informed tradeoffs to reap higher returns from their investments in design options.

The study also contributes to the digital innovation with respect to the notion of design options that could be used for recombination and repurposing for strategic flexibility. The choice about the scope of design, for instance, can shape the value of the design option with respect to future decisions about further investments in designs. It is not clear how design focusing on the platform core versus new features would affect opportunities for repurposing (Antonopoulo et al., 2016) and recombination (Henfridsson et al., 2014) nor the quality of the derivative products. In

the case of the medication adherence example, the designers believed that expansion of the existing task feature required rework but expanded possibilities for future task types, thus increasing value of the feature in the long run. It could be speculated that choosing to design for the platform core instead of new features would increase resources directed to the design of the platform core. A focus on the platform core could subsequently increase quality of the platform core in the long term. The findings imply that a more focused form of options assembly may help entrepreneurial firms in the early stage move closer to reaping the benefits of an options approach. A more rigorous discussion on the focus on platform core versus new features on the periphery can contribute to understanding mechanisms for value creation through design options.

5.2 Implications of Assembling a Portfolio of Options

The findings suggest that a focus on features as individual options rather than their assembly into a whole offering may have led the firm to be less successful with potential clients and new business opportunities or require much higher future investment to do so. In modular architecture, changes in technology (and correspondingly business strategy) could be made without disrupting the platform core. However, because of the focus on individual design options, interdependencies and long term viability of the design options were often deferred in the firm. For instance, in Finding 3, instead of discussing the interdependencies between care plans and disease types, these discussions were largely deferred. Deferment of these discussions could limit the firm's ability to exercise the design option in the future, as it may require massive rework to enable the platform to accommodate scale and complexity of disease types.

The real options literature also assumes that uncertainty decreases over time for the firm (Dixit & Pindyck, 1994). However, the findings suggest that lack of consideration of the whole assembly of functions may lead to investment in design options that are wasted in the long run. Similarly, digital innovation researchers promote variety through recombination in a platform to increase the ability of the technology to serve multiple, emerging user needs (Gawer & Cusumano, 2008). However, this case study highlights that for design options to continue creating value for the platform in the long run, attention to interdependencies is critical. Lack of discussion about these interdependencies resulted in a platform with technical robustness issues for PatientFirst. This made it hard for PatientFirst to scale within segments to bigger and more established clients within those segments. As a result, focus on individual digital options led to decreased strategic flexibility for the firm, as the firm faced difficulties in the sales process.

5.3 Practical Implications

This paper begins to make sense of how digital entrepreneurs approach the design of platforms and their digital businesses. A key contribution of Finding 2 and 3 is a recommendation on how to prioritize investments in design options. The modular architecture and the pursuit of a flexible design methodology led to the assembly of a rather disparate offering, as the firm designed features as individual design options to meet client needs. The findings have implications for modular designs and flexible methodologies as well-accepted design practices for resource constrained firms developing systems requiring high reliability and quality. Choosing to design for the

platform core instead of new features could increase resources directed to the design of the platform core and subsequently quality in the long term. The disregard for the overall technology architecture affected the overall quality and the firm's ability to harness integrative value from the features.

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